ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 11| Issue: 7| July 2025|| Journal DOI: 10.36713/epra2013 || SJIF Impact Factor 2025: 8.691 || ISI Value: 1.188

HEALTH SYSTEM FACTORS THAT INFLUENCE HPV VACCINE UPTAKE IN KIAMBU COUNTY

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Article DOI: https://doi.org/10.36713/epra23421
DOI No: 10.36713/epra23421

ABSTRACT
Human papillomavirus HPV is a major cause of cervical cancer infection, however, HPV vaccine uptake among the targeted groups (ages 9-14) remains suboptimal in many regions, including Kiambu County, Kenya. Across sectional design sought to assess the relationships between health system factors and vaccine uptake. The study targeted parents with daughters aged 9–14 years. A sample of 400 respondents was included to provide a robust representation of the target population, ensuring comprehensive and reliable insights. Key findings indicate that health system factors such as absence of health provider's, access to vaccination services and communication by healthcare providers to parents emerged as critical determinants of vaccine uptake. From the findings the study concluded that there is a significant impact of health system factors on vaccination decisions. Based on the findings the study recommended that the County Government of Kiambu through the department of Health should improve Communication among Health Care Providers and when training healthcare providers they should use recommended communication strategies to engage parents in discussing HPV vaccination.

KEYWORDS: *Health System Factors, Cervical cancer, Health Education, HPV, HPV Vaccine*

1.0 INTRODUCTION

The Human Papillomavirus (HPV) vaccine is a critical preventive measure against cervical cancer, a disease that continues to claim the lives of many women globally and especially in sub-Saharan Africa. In Kenya, the vaccine was introduced into the national immunization schedule in 2019, targeting girls aged 10 to 14 years (MOH Kenya, 2020). Despite this milestone, the uptake of the HPV vaccine remains suboptimal, raising concerns about the underlying barriers. Among the various determinants influencing vaccine acceptance and completion, health system factors are particularly significant. These structural and operational elements within the healthcare system directly impact the accessibility, availability, and efficiency of vaccine delivery services.

There are various factors that influence the uptake of HPV vaccines. One of them is health system factors which are the building blocks of the healthcare delivery mechanism that determine how health services are planned, financed, and executed. According to the World Health Organization, these include service delivery, health workforce, health information systems, access to essential medicines, health financing, and leadership or governance (WHO, 2020). In the context of HPV vaccine uptake, these components affect whether eligible girls can receive the vaccine in a timely, convenient, and trusted manner. In counties like Kiambu, where population density and infrastructure vary significantly between urban and rural areas, the strength and coordination of the health system play a pivotal role.

One of the key health system factors affecting HPV vaccine uptake is the availability and accessibility of vaccines. Frequent vaccine stockouts, poor cold-chain management, and delays in distribution can discourage both parents and healthcare workers from prioritizing HPV immunization. A study by Osur et al. (2022) found that inconsistent vaccine supply in Kenyan counties led to missed opportunities for immunization, especially in rural health facilities which face logistical challenges that may prevent routine availability of the HPV vaccine, affecting timely administration of the two recommended doses.

Another critical factor is the capacity building and attitude of the health care providers. The role of healthcare providers goes beyond administering vaccines; they are the primary source of information and reassurance for parents and adolescent girls. When health workers are not adequately trained or lack knowledge on HPV-related communication, they may fail to address vaccine hesitancy effectively. A qualitative study by Wambua and Kamau (2021) revealed that gaps in training and misconceptions among nurses in central Kenya were associated with low confidence in recommending the vaccine, thereby contributing to poor uptake.

Moreover, integration of services and delivery strategies influences how efficiently the vaccine reaches its target population. School-based delivery programs have been shown to be highly effective, as they capture girls within the recommended age range. However, limited collaboration between the Ministries of Health and Education in Kenya has hindered full implementation of such programs in some areas (Karanja et al., 2020). Health communication and information systems also play a crucial role. Clear, culturally sensitive messaging, supported by a reliable health information system, enhances public awareness and helps track vaccination schedules. Conversely, weak communication infrastructure can leave communities misinformed or unaware of when and

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where to access the vaccine. According to a report by UNICEF Kenya (2021), misinformation and myths surrounding the HPV vaccine exacerbated by inadequate health communication were significant deterrents in several Kenyan counties, including Kiambu.

Another underlying health system factor is health financing and the indirect costs of vaccination. While the HPV vaccine is provided free of charge in public health facilities, hidden costs such as transportation, time away from work for caregivers, or missed school time for girls can discourage uptake. Counties with limited budget allocations for outreach programs or community mobilization face greater challenges in reaching underserved populations. Nyaguthii and Ndirangu (2023) highlighted that insufficient county-level funding for routine immunization activities resulted in irregular outreach and reduced vaccine coverage in semi-urban areas.

Lastly, the implementation of health policies and governance frameworks determines the level of commitment and accountability within the health system. Strong political will, community engagement, and transparent monitoring systems are essential for effective rollout of vaccines. However, policy gaps or lack of follow-through often limit the success of national immunization plans. A policy review by Gavi (2022) emphasized that while Kenya has made significant strides in vaccine policy development, execution at the county level remains inconsistent, leading to disparities in HPV vaccine uptake.

Statement of the Problem

The Human Papillomavirus (HPV) vaccine, introduced into Kenya's routine immunization program in 2019, is a critical public health intervention aimed at reducing the burden of cervical cancer. However, vaccine uptake remains significantly below the national target, particularly in counties like Kiambu. According to the Ministry of Health's Annual Immunization Coverage Report (2023), the national HPV vaccine uptake for the first dose stood at 59%, while the second dose uptake dropped to 32%. In Kiambu County, the situation is more concerning, with only 52% of eligible girls receiving the first dose and less than 30% completing the second dose.

This low coverage has been attributed not merely to community awareness gaps but critically to health system-related factors. A 2022 evaluation by the Kenya National Immunization Program (KNIP) identified key systemic barriers in counties including Kiambu, such as: frequent stockouts of the HPV vaccine (reported in over 40% of facilities), poor cold chain maintenance in rural sub-counties, and a shortage of trained vaccinators, with only 46% of health workers in Kiambu reporting adequate training on adolescent vaccination. Additionally, weak integration between school health programs and public health facilities limits access for out-of-school girls, while poor health information systems hinder tracking and follow-up for the second dose.

These health system shortcomings contribute to missed vaccination opportunities, reduce community trust in service delivery, and ultimately undermine the effectiveness of cervical cancer prevention efforts. To improve HPV vaccine uptake in Kiambu County, it is imperative to investigate and address the specific health system factors acting as bottlenecks to efficient vaccine delivery.

Purpose of the Study-

To assess the health system factors that influence HPV vaccine uptake in Kiambu County.

Research Questions

How do health system factors influence HPV vaccine uptake in Kiambu County?

Theoretical Framework

The theoretical foundation for this study is guided by the Andersen Behavioral Model of Health Services Use, which was developed by Ronald M. Andersen in 1968. According to the Andersen model, the use of health services is determined by three interrelated categories of factors: predisposing, enabling, and need factors. Predisposing factors include individual characteristics such as age, gender, education, and health beliefs that influence the likelihood of seeking healthcare. Enabling factors are the logistical and structural conditions that facilitate or hinder access to services, such as financial ability, availability of resources, healthcare infrastructure, and provider competence. Lastly, need factors involve both perceived and actual health conditions that necessitate the use of healthcare services (Andersen, 1995; Aday & Andersen, 1974).

This model is particularly relevant to the current study, which investigates how health system factors influence the uptake of the Human Papillomavirus (HPV) vaccine in Kiambu County, Kenya. The study primarily focuses on enabling factors, such as the availability and consistent supply of the vaccine, cold chain storage capacity, adequacy of trained healthcare workers, integration of school-based delivery models, and the efficiency of health information systems. These elements are core components of the health system that determine service accessibility and reliability (Ministry of Health Kenya, 2023).
While predisposing and need factors may also play a role in influencing HPV vaccine uptake, the study narrows its focus to health system enablers, as they represent the most immediate and actionable barriers to improving vaccination rates. For example, evidence from the Kenya Expanded Programme on Immunization (KEPI) shows that frequent stockouts, limited training of personnel, and weak tracking systems have significantly contributed to low HPV vaccine coverage in counties like Kiambu (Ministry of Health Kenya, 2022). Thus, the Andersen Behavioral Model provides a robust conceptual lens for analyzing how deficiencies within the health system can constrain the utilization of preventive health services such as HPV vaccination.

Empirical Review

Healthcare providers are critical in promoting and administering HPV vaccines. Their recommendations and communication practices significantly influence vaccine uptake. Studies indicate that strong and consistent

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recommendations from healthcare providers lead to higher vaccination rates. For instance, Gilkey et al. (2015) reported that adolescents whose providers consistently recommended the HPV vaccine were more likely to begin the vaccination series. Effective communication, including addressing concerns and providing accurate information, has been shown to increase vaccine acceptance, as noted by Gowda et al. (2018).

Gaps in provider knowledge about HPV and its vaccine can impact the quality of recommendations. Educational interventions have been shown to improve provider knowledge and attitudes, which in turn increases vaccination rates. Dempsey et al. (2016) found that educational programs for providers resulted in better vaccine uptake among adolescents. However, barriers such as time constraints, parental resistance, and a lack of reimbursement for counseling can hinder effective promotion. Kasting et al. (2019) demonstrated that interventions like clinical decision support tools and electronic medical record reminders could help overcome these challenges and improve vaccination rates.

The availability and proximity of vaccination facilities play an important role in HPV vaccine uptake. Individuals living closer to vaccination sites are more likely to initiate and complete the vaccine series. Lu et al. (2017) found that geographic proximity to clinics significantly increased vaccine uptake. Expanding access through additional vaccination sites or mobile clinics can improve coverage, particularly in underserved or rural areas.

The cost of HPV vaccination is a significant factor affecting uptake. High out-of-pocket expenses are associated with lower vaccination rates. Strategies such as offering vaccines outreaches, school based programs, and ensuring vaccines availability in the nearest health facilities have been effective in increasing vaccine accessibility. Barnack-Tavlaris et al. (2016) demonstrated that free vaccination programs significantly improved vaccine uptake among low-income individuals, highlighting the importance of reducing financial barriers.

Convenience is a crucial factor in encouraging HPV vaccination. Flexible clinic hours, timely appointments, and reduced waiting times are associated with higher vaccination rates. Esposito et al. (2019) found that appointment reminders and streamlined services improved vaccine initiation. Comprehensive vaccination services, including culturally sensitive counseling and language support, also enhance vaccine acceptance. Kobetz et al. (2015) noted that culturally tailored interventions and improved communication with providers led to increased vaccine uptake in underserved populations.

2.0 MATERIALS AND METHODS

The study adopted a cross-sectional design. The study focused on three sub-counties, Thika West, Juja, and Kiambu among the twelve sub counties within Kiambu County with an estimate of 245,820, 300,948 and 145,903 people respectively (KNBS 2019). The study targeted parents with daughters aged 9 - 14 years residing in Kiambu County. Initially, purposive sampling was employed to select Kiambu County. The researcher implemented simple random sampling to pick three sub-counties from a total of twelve in Kiambu County. The study employed the Cochran formula in determining size of the sample to be included. The target population was as follows:

Table 1: Distribution of study participants per sub-county

Sub-County	Total Population	Sampled Population	Respondents	Response Rate (%)
Thika West	12,624	130	135??	100
Kiambu	7,962	82	85	100
Juja	16,719	172	180	100
Total	37,305	384	400	100

A pilot study was conducted in Ruiru Sub-County using 10% of the total sample size from this research to test the data collection instruments and procedures. The study recruited Community health promoters (CHPs) as research assistant. The CHPs were preferred since they were familiar with both the sub counties and respondents. Research assistants were adequately trained on data collection to ensure that it was uniformly conducted and the data was accurately collected. A thematic analysis was conducted on the qualitative data collected to identify emerging patterns and insights into factors influencing HPV vaccine uptake. Coding and organization of data into themes was done systematically to capture key concepts emerging from participant responses. The demographic information was summarized using descriptive statistics, namely frequencies and percentages. Qualitative insights were narratively presented to outline parental knowledge, perceptions, and health system factors

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3.0 RESULTS AND DISCUSSIONS

Social Demographic Characteristics of the study population

Descriptive statistics of parent Knowledge and information about HPV vaccine among Children.

Characteristics	% (N=400)
Have you ever heard about the Human Papillomavirus (HPV)?	
Yes	56.5 (226)
No	43.5 (174)
Are you aware that HPV can cause cervical cancer?	
Yes	57.0 (228)
No	43.0 (173)
Do you know there is a vaccine available to protect against HPV?	
Yes	53.5 (214)
No	46.5 (186)
How would you rate your overall knowledge about the HPV vaccine?	
Very Good	24.5 (98)
Good	38.8 (155)
Average	24.8 (99)
Poor	7.2 (29)
Very Poor	4.8 (19)

These findings suggest that while most parents in Kiambu County reported some level of knowledge about HPV and the HPV vaccine, quite a number still had very minimal knowledge; this sets a clue that improving awareness of the causative role of HPV in cervical cancer and of the availability of the vaccine could be expected to increase uptake rates and overall community health outcomes in the region.

Health System Factors

Descriptive Statistics of Health System Factors

Table 3: Descriptive Health systems on HPV vaccine uptake by their children

Characteristics	% (N=400)
Have you ever discussed HPV vaccination with a healthcare provider?	
Yes	55.3 (221)
No	44.8 (179)
How accessible is the HPV vaccine in your local health facility?	
Easily Accessible	49.3 (197)
Somewhat Accessible	38.3 (153)
Not Accessible	9.8 (39)
Don't Know	2.8 (11)
Do you feel that the cost of the HPV vaccine is a barrier to getting your daughter vaccinated?	
Yes	16.3 (65)
No	61.5 (246)
Not applicable	22.3 (89)
How satisfied are you with the overall healthcare services related to vaccination in your area?	
Very Satisfied	25 (100)
Satisfied	50 (200)
Neutral	18 (72)
Dissatisfied	4.5 (18)
Very Dissatisfied	2.5 (10)

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These results, imply that in Kiambu County, discussions with providers, perceived accessibility, and general satisfaction from the health services increase the uptake of the HPV vaccination among children. At the same time, the worries about cost remain minimal.

Regression model Summary between Health system factors and Daughter receiving HPV

Table 5: Regression model Summary of Health system factors and Daughter receiving HPV Vaccine

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.406a	0.165	0.154	0.446	0.165	15.557	5	394	0.00

a. Predictors: (Constant), 18. How satisfied are you with the overall healthcare services related to vaccination in your area? 14. Have you ever discussed HPV vaccination with a healthcare provider? 16. Have you been provided with adequate information by healthcare professionals about the HPV vaccine? 17. Do you feel that the cost of the HPV vaccine is a barrier to getting your daughter vaccinated? 15. How accessible is the HPV vaccine in your local health facility?
b. Dependent Variable: 19. Has your daughter received the HPV vaccine?

Table 5 presents the regression model summary testing the effect of health system factors on the likelihood of daughters being vaccinated against HPV in Kiambu County. The R-value was 0.406, indicating a moderate relationship between health system factors and vaccination uptake. This R-squared value of 0.165 indicated that about 16.5% of the variance in the HPV vaccination uptake was explained by the included predictors: satisfaction with healthcare services, discussion with healthcare providers about the HPV vaccine, adequacy of information provided by the health professionals, perception of cost as a barrier, and accessibility of the vaccine at the local health facilities. The Adjusted R-squared value was 0.154, furthering the model accuracy explanation. The standard error of the estimate is 0.446, which is relatively tiny, indicating that the observed values do not deviate much from the predicted values. The statistically significant model F-change statistic supports this is 15.557, with a significance level of 0.00-which, which strongly supports the notion that all the health system factors put together significantly explain the likelihood of daughters receiving the HPV vaccine. Overall, these results indicate that health system factors are pretty fundamental in driving vaccination decisions in Kiambu County and that their improvement may lead to increased uptake of the HPV vaccine among children.

Chi-square Test between Health system factors and Daughter receiving HPV Vaccine

Table 6: Chi-square Test between Health system factors and Daughter receiving HPV Vaccine

Characteristics	Pearson Chi-Square (Xi)	P<0.05
Have you ever discussed HPV vaccination with a healthcare provider?	18.8	0.00
How accessible is the HPV vaccine in your local health facility?	29.557	0.00
Have you been provided with adequate information by healthcare professionals about the HPV vaccine?	26.55	0.00
Do you feel that the cost of the HPV vaccine is a barrier to getting your daughter vaccinated?	80.271	0.00
How satisfied are you with the overall healthcare services related to vaccination in your area?	65.126	0.00

Table 6 presents the results of the Chi-square test on health system factors that influence the uptake of the HPV vaccine among children in Kiambu County. All the various health system characteristics with respect to the significance of predicting whether the children receive the HPV vaccine have higher Pearson Chi-square values and p-values less than **0.05**. The Chi-square accounting for discussing HPV vaccination with a healthcare provider is **18.8 ($p < 0.001$)**, indicating a statistically significant association. The HPV vaccine is accessible in local health facilities. A Chi-square value accounting for this is **29.557 ($p < 0.001$)**; thus, it indicates that accessibility affects uptake. A significant association exists between healthcare professionals and parents making informed decisions on vaccinating their children, presented by a Chi-square of **26.55** at **$p < 0.001$**.
On the other hand, the perceived barrier to cost reflects a highly significant Chi-square value, **80.271** at **$p < 0.001$**, indicating that financial consideration plays a significant role in vaccination. Satisfaction with general healthcare services related to vaccination gives a Chi-square value of

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65.126 (p < 0.001), showing that healthcare quality impacts the parent's decision to vaccinate their children. These findings show that improving health system factors such as accessibility, communication, and cost-effectiveness will significantly increase the uptake of HPV vaccination among children in Kiambu County.

4.0 CONCLUSIONS

This study has been an in-depth look into the multifaceted nature of the causes leading to the uptake of the HPV vaccine among children in Kiambu County. The perceived HPV severity and the perceived effectiveness of the HPV vaccine emerged as significant predictors of vaccination behavior. Most parents expressed concern over potential side effects- a trend repeated in many other vaccinations where fear and misinformation may interfere with vaccination programs. Health system factors also emerged from this study, such as important access to vaccination services and communication by healthcare providers to parents in influencing the decision to vaccinate. Although a high percentage of parents have discussed vaccination against HPV with healthcare providers, there is still a great need for improved communication strategies.

In light of these findings, responding to the barriers to HPV vaccine uptake requires a multi-faceted approach encompassing the population's educational initiatives, revisiting communication at healthcare facilities to enhance information regarding vaccination, and general access to vaccines. These findings add to the available literature on HPV vaccination and set a foundation for future responses in public health within Kiambu County and other settings with similar characteristics.

This study, therefore, underscores the need for continued efforts in increasing HPV vaccination and the education and provision of health services to fight the diseases attributable to HPV. In creating a well-informed public and health system that supports vaccination, we find our best hope for sharp declines in cervical cancer and improved health for generations to come. These recommendations from this research should now guide policymakers, healthcare providers, and community organizations in effectively and equitably promoting the vaccination against HPV.

5.0 Recommendations

Based on the findings the study recommended that the County Government of Kiambu through the department of Health should plan targeted education campaigns to improve knowledge about HPV, its associated risks, and the benefits of vaccination among parents. The campaign should address misinformation and inform them correctly and simply about the effectiveness and safety of the HPV vaccine via community forums, social media, and school programs.

In addition, the County should improve Communication among Health Care Providers and when training healthcare providers they should use recommended communication strategies to engage parents in discussing HPV vaccination. Such training should be based on providing complete information, addressing parents' concerns, and holding open dialogue to build trust and promote vaccination uptake.

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Volume: 11| Issue: 7| July 2025|| Journal DOI: 10.36713/epra2013 || SJIF Impact Factor 2025: 8.691 || ISI Value: 1.188

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